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Growth and Instability in Area, Production and Productivity of Major Pulses in Maharashtra

Statistic

KEYWORDS: Compound growth, pulse crops, Instability index.

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ABSTRACT

An attempt was made to estimate the growth in Area, Production and Productivity of Pulses in Maharashtra. The present study is based on secondary data for the period from (1960-61 to 2014-15). The period wise compound growth rates were calculated. The overall growth rates showed a significant positive growth in area under tur, gram and total pulses while Green gram, Black gram showed non- significant. The positive and significant growths in production were recorded for tur, green gram, black gram, gram and total pulses. The overall growth rates showed a significant positive growth in productivity under tur, green gram, black gram, gram and also for total pulses. The reason for the increase in overall growth of area, production and productivity in the whole Maharashtra under all the pulses might be due to better relative prices. The state registered highest instability index of overall period (1960-61 to 2014-15) in area(23.36 per cent), production (44.18 per cent) and productivity (30.83 per cent) for green gram followed by gram for area and production, productivity for black gram. The lowest Cuddy Della instability was recorded in area(8.80), production(10.87) and productivity(16.99) for tur and total pulses respectively.

Introduction

A variety of pulse crops are grown in India and world. Pulses are consumed as Dal, which is a cheap source of plant protein. These are consumed because of body building properties due to presence of various amino acids. These also have medicinal properties. By products of pulses like leaves, pod coats and bran are fed to animals in the form of dry fodder. Some pulse crops like Gram, Lobia, Black gram & Green gram are fed to animals as green fodder. Moong plants are also used as green manure which improve soil health and adds nutrient into the soil.

In the world, pulses are grown by 171 countries. At triennium ending 2010-11, the total area under pulses was 723 lakh ha. This area provided about 644.08 lakh tones of pulses with a productivity of 890 kg / ha. The highest area was contributed by India (32.24 %) followed by Niger (7), Myanmar (5.33), Brazil (5.29) and Nigeria (4.44). Similarly, the contribution to total production by India was 23.46%, Canada 7.93, China 7.09, Myanmar 6.89 and Brazil 5.29. The highest productivity was of France (4219 kg / ha) followed by Canada (1936), USA (1882), Russian Federation (1643) and China (1596). There was 239 lakh ha area in India (2010-11), which was mainly contributed by Madhya Pradesh, Rajasthan, Maharashtra, Karnataka and Uttar Pradesh. From this area, 158 lakh tonnes produce of pulse was received. The major contributors of this production were Madhya Pradesh, Maharashtra, Uttar Pradesh, Rajasthan and Andhra Pradesh. During this period, productivity of pulses was recorded 661 kg / ha with highest in Punjab (905 kg/ha), Haryana (891), Bihar (839), Uttar Pradesh (823) and West Bengal (811). [Govt. of India, Ministry of Agril, Bhopal].

Maharashtra is considered as one of the heterogeneous states in Indian Union as far as the varying agro-climatic conditions are concerned. The variability in topography, soil and climatic factors bear significant impact on crop and land use pattern. Gross cropped area of the state increased from 188.23 to 231.06 lakh hectares during last fifty five years while the gross irrigated area increased from 12.20 lakh hectares to 49.26 lakh hectares during the same period. Due to good rainfall, the kharif acreage has increased by 21 per cent over the previous year. The area under pulses has increased by 54 per cent, with Black gram registered the highest increase followed by Tur and Green gram at 64 per cent and 46 per cent respectively.

The growth in area and production largely varies from crop to crop of the state indicated large variation and instability in production in the state. The Agriculture production is very sensitive. The growth process in agriculture sector does not operate at even pace and increase in agricultural return is a great need of agriculture sector. The agriculture growth with stability has been a matter of great concern. The stable agriculture growth needs to be achieved. Thus considering the importance and need, the present study has been undertaken to study growth and instability in area, production and productivity of major crops of pulses in Maharashtra.

Research Methodology

The pre to sent study utilizes the time series data (1960-61 to 2014-15) on area, production and productivity of pulses was collected from various publications and websites of Directorate of Economics and Statistics Govt. of India, Agricultural Statistics at a Glance. The period wise growth in area, production and productivity under major pulses crop of Maharashtra was estimated using the compound growth rate of the form as-

Period I - 1960-61 to 1969 -70, Period II - 1970-71 to 1979 -80,
Period III - 1980-81 to 1989 -90, Period IV - 1990-91 to 1999 -00,
Period V - 1999-00 to 2009 -10, Period VI - 2010-11 to 2014 -15,
Period VII- Overall (1960-61 to 2014-15).

Equation of compound growth rate

$\mathbf{Y_t = ab^t}$

Where,

Y_t = Dependent variable in period t
(Area/production/productivity
a = intercept
b= Regression coefficient
t = Years which takes values 1,2,....n

The equation was transformed in to linear form by taking logarithm on both sides for estimation purpose. The compound growth rate (r) in percentage was then computed using the equation as-

Compound growth rate (r) = [Antilog (b) -1]*100

The compound growth rates were tested for their significance by the Student's t-test.

Instability Analysis

There are a number of techniques available to measure the index of instability. Such techniques are found in Coppock (1962), Weber and Sievers (1985) and Cuddy-Della Valle (1978). The present study applies the Cuddy Della Valle Index for measuring the instability. This Index first de-trends the given series and gives a clear direction about

the instability. The use of coefficient of variation as a measure to show the instability in any time series data has some limitation. If the time series data exhibit any trend the variation measured by CV can be over-estimated, i.e. the region which has growing production are at constant rate will score high in instability of production if CV is applied for measuring instability. As against that Cuddy-Della Valle index attempts de-trend the CV by using coefficient of determination (R^2). Thus it is a better measure to capture instability in agricultural production. A low value of this index indicates the low instability in farm production and vice-versa.

In this study the instability in area, production and productivity of major pulses in Maharashtra crops are measured in relative terms by the Cuddy - Della Valle which is used in recent years by a number of different scientists or researchers as a measure of variability in time series data. In order to study the variability in area, production and productivity of major pulses in Maharashtra State, an instability index by Cuddy and Della (1978) was used.

$$Instability\ Index = CV \times \sqrt{(1 - R^2)}$$

With R^2, the corrected goodness of fit of a time trend regression.

Coefficient of variation was multiplied by the square root of the difference between the unity and coefficient of multiple determinations (R^2).

Results and Discussion

Compound growth rate

The compound growth rates of area, production and productivity of major pulse crops in Maharashtra State for the period I (1960-61 to 1969 -70), Period II - 1970-71 to 1979 -80, Period III (1980-81 to 1989 - 90), Period IV (1990-91 to 1999 -00) Period V (1999-00 to 2009 -10) , Period VI (2010-11 to 2014 -15) and overall Period VII- (1960-61 to 2014-15) were worked out and depicted in Table 1.

It is observed that Tur crop had highly significant positive growth rate of area (3.71 per cent) during period III and also for production (6.36 per cent) resp. The similar results were reported by Saraswati *et al.* (2012). However, productivity showed non- significant growth of same period. The productivity growth decreased in period I (-5.14 per cent) and there was non - significant in period VI. However, positive non- significant growth rate of productivity of tur was reported by Saraswati *et al.* (2012) for same period.

For Green gram, the area growth rate was highest and positive during period III (3.65 per cent). The results are agreement with the findings by Saraswati *et al.* (2012). However area highly decreased significantly during period VI (-15.67 per cent). The production of green gram significantly decreased in period VI (-19.69 per cent) followed by period V(-13.68 per cent) and highly positive significant growth rate was observed during period II (13.25 per cent). The growth in productivity of green gram was significantly positive during period II (10.54 per cent) followed by period III (7.74 per cent) and overall period by (1.53 per cent). However significantly decrease in productivity was observed in period VI (-10.21 per cent) which was due to the area and production of both were having negating significant growth rates.

In case of Black gram, the state registered an increase in area growth rate during period IV(3.42 per cent). The similar result was also reported by Saraswati *et al.* (2012). However the production and productivity were non-significant during the same period. Black gram showed declining growth rate(-12.12 per cent) followed by period V (-7.23 per cent).The production growth rate of state in black gram had highly positive significant was observed in period II (9.46 per cent) followed by period III(8.48 per cent) and overall period by (1.57 per cent).The highest negative growth of production was observed during period VI (-23.14 per cent) followed by period V(-7.58 per cent). The highly significant positive growth rate of productivity was recorded in period II (8.86 per cent) followed by period III (6.69 per cent) and overall period by (1.67 per cent). The highest significant negative growth rate was observed in period VI (-12.53 per cent) which was due to the simultaneous decrease in area and production of this period.

The Maharashtra state registered a highly significant increase in area of growth rate of gram by (8.26 per cent) during period V and decling growth rate (-1.88 per cent) during the period I. In case of production growth rate of gram in the state, it is highly positive significant increase during period V (14.23 per cent) followed by period III (10.12 per cent) and it is observed that significant decling growth rate (-4.18 per cent) during period I. Gram recorded significant increment in productivity in the state during period V (4.78 per cent) this might be due to the increment in area and production in this period. However, all the rest period showed that non-significant growth rate of productivity except the overall period. The overall performance of gram in the state was good and increasing growth rates of area, production and productivity.

The total pulses of Maharashtra State recorded highest positive increasing growth rate (3.10 per cent) during period I followed by period III (2.12 per cent). The similar results was obtained by Saraswati *et al.* (2012).The production under total pulses showed a significant increment in the state during period III. The similar result was agreement with the findings by Sihmar (2014) during period 1980-86 in Haryana for total pulses production growth rate. This might be due to the increase in area and productivity of total pulses. The overall performance of the total pulses in the state showed that there was a significant increasing growth of area, production and productivity by 1.29 percent, 2.81 per cent and 1.50 per cent respectively. The reason for the increase in overall growth of area, production and productivity in the whole Maharashtra under all the pulses might be due to better relative prices.

Instability Analysis

The results of the instability analysis are depicted in Table 2. The table revealed that the highest instability of Tur in area (8.13per cent), production (27.57 per cent) and productivity (27.08 per cent) was observed during period II, Period IV for both production and productivity. The lowest in area (2.10 per cent), production (14.22 per cent) and productivity (11.39 per cent) was recorded during the period I for area and production resp. and period III for productivity of Tur crop in the State. The largest instability of green gram in area (42.62 per cent), production (36.48 per cent) and productivity (30.95 per cent) was estimated for period VI, Period V for both production and productivity. Sihmar (2014) reported the similar result while examining the instability of moong during the periods, 1980-90, 1990-2000 and 2000-07 resp. in Haryana. The minimum instability of green gram in area (8.59 per cent), production (9.35 per cent) and productivity (4.32 per cent) was observed during period period I resp. The instability of black gram in area, production and productivity were observed to be highest (30.48 per cent), (33.55 per cent) and (66.67 per cent) during period VI and period V resp. The state registered high instability index of gram in area (68.70 per cent), production (73.44 per cent) and productivity (55.54 per cent) during period VI. Similar results were reported by Sihmar R. (2014) for gram in Haryana and Sharma et al. (2014) for Guarseed in Rajasthan.

The state observed highest instability of total pulses in area, production and productivity (61.50 per cent), (61.14 per cent) and (57.79 per cent) during period VI resp. The minimum instability for area (4.65 per cent), production (14.60 per cent) and productivity (10.94 per cent) was observed during period IV, III and II resp. The findings of the study are in line with the results obtained by Sharma *et al.* (2014) for area in Sikar, production and productivity for Ganganagar of guarseed during the period 1991-2000 in Rajasthan.

The state registered highest instability index of overall period in area (23.36 per cent), production (44.18 per cent) and productivity (30.83 per cent) for green gram followed by gram for area and production, productivity for black gram. The lowest instability was recorded in area (8.80 per cent), production (10.87 per cent) and productivity (16.99 per cent) for Tur and Total Pulses respectively.

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Table1. Period wise Compound Growth Rates of Area, Production and Productivity of Pulses in Maharashtra (in %).

Period	Tur	Green gram	Black gram						
	A	P	Y	A	P	Y	A	P	Y
Period I (1960-61 to 1969 -70)	1.67**	-3.54*	-5.14**	3.13**	2.66**	-0.45NS	2.22**	1.15NS	-1.05NS
Period II (1970-71 to 1979 -80)	2.43*	6.36**	3.84*	2.45NS	13.25**	10.54**	1.15NS	9.46**	8.86**
Period III (1980-81 to 1989 -90)	3.71**	6.36**	2.52NS	3.65**	11.67**	7.74**	1.67**	8.48**	6.69**
Period IV (1990-91 to 1999 -00)	0.36NS	5.71NS	5.71NS	-1.98**	0.54NS	2.58NS	3.42**	4.41NS	0.96NS
Period V (2000-01 to 2009 -10)	0.22NS	1.94NS	1.12NS	-6.34**	-13.68*	-7.74NS	-7.23**	-7.58*	-0.38NS
Period VI (2010-11 to 2014 -15)	-5.26**	-6.10 NS	-0.89NS	-15.97*	-19.69**	-10.21**	-12.12**	-23.14**	-12.53*
Overall Period (1960-61 to 2014-15)	**1.69****	**2.40****	**0.67****	**0.31NS**	**1.96****	**1.53****	**-0.10NS**	**1.57****	**1.67****

Period	Gram	Total Pulses				
	A	P	Y	A	P	Y
Period I (1960-61 to 1969 -70)	-1.88**	-4.18*	-2.35NS	-0.09NS	-2.72NS	-0.68NS
Period II (1970-71 to 1979 -80)	3.75*	7.55*	3.66NS	3.10*	6.31*	3.10*
Period III (1980-81 to 1989 -90)	4.73**	10.12**	4.14NS	2.12**	7.14**	4.91**
Period IV (1990-91 to 1999 -00)	5.77**	7.10*	1.25NS	0.97NS	4.69NS	3.65NS
Period V (2000-01 to 2009 -10)	8.26**	14.23**	4.78**	-0.10NS	3.10NS	3.20*
Period VI (2010-11 to 2014 -15)	2.03NS	-2.32NS	-3.73NS	-4.01NS	-7.24NS	-3.34NS
Overall Period (1960-61 to 2014-15)	**2.79****	**4.99****	**2.09****	**1.29****	**2.81****	**1.50****

***Significant at 5% and ** significant at 1% l.s.**

Table 2. Crop wise per cent of Cuddy Della Valle instability Index in area, production and productivity of major pulses in Maharashtra State (1960-61 to 2014-15).

Period	Tur	Green gram	Black gram						
	A	P	Y	A	P	Y	A	P	Y
Period I (1960-61 to 1969 -70)	2.10	14.22	14.17	8.59	9.35	4.32	3.70	11.94	11.08
Period II (1970-71 to 1979 -80)	8.13	18.52	13.85	11.63	26.57	24.95	5.87	20.76	17.66
Period III (1980-81 to 1989 -90)	4.76	15.29	11.39	10.14	16.21	11.74	5.84	14.76	12.51
Period IV (1990-91 to 1999 -00)	3.33	27.57	27.08	6.57	30.85	27.87	4.59	20.13	18.60
Period V (2000-01 to 2009 -10)	4.57	18.17	11.51	12.38	36.48	30.95	13.31	32.55	66.67
Period VI (2010-11 to 2014 -15)	2.32	16.21	15.57	42.62	23.11	18.38	30.48	33.55	42.68
Overall Period (1960-61 to 2014-15)	**8.80**	**22.81**	**19.53**	**23.36**	**44.18**	**30.83**	**18.21**	**35.38**	**24.96**

Period	Gram	Total Pulses				
	A	P	Y	A	P	Y
Period I (1960-61 to 1969 -70)	5.82	14.98	11.76	9.84	15.16	11.99
Period II (1970-71 to 1979 -80)	13.56	25.23	17.45	11.72	19.74	10.94
Period III (1980-81 to 1989 -90)	6.80	31.54	22.88	5.05	14.60	11.11

Period IV (1990-91 to 1999 -00)	12.68	25.03	17.61	4.65	24.29	21.91
Period V (2000-01 to 2009 -10)	10.48	17.46	8.70	8.09	19.25	11.91
Period VI (2010-11 to 2014 -15)	68.70	73.44	55.54	61.50	61.14	57.79
Overall Period (1960-61 to 2014-15)	**18.71**	**36.14**	**18.46**	**10.87**	**21.15**	**16.99**

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